1988 GYPSY MOTH INTEGRATED PEST MANAGEMENT PROGRAM ACTIVITIES

Project Summary

FORT NECESSITY NATIONAL BATTLEFIELD
FARMINGTON, PENNSYLAVANIA

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BACKGROUND

In 1987, an intensive gypsy moth monitoring/IPM program was initiated at Fort Necessity National Battlefield. The object of this program was to intensify monitoring efforts in order to track gypsy moth build-up and to initiate and evaluate tactics that show promise in low level population management prior to the occurrence of wide-spread defoliation.

The 750 feet grid system established in 1987 now has 43 grid points at which male moth trapping and egg mass surveys are conducted annually. Burlap banding has been conducted at selected grid points to monitor pupae and larvae densities. In 1988, a mating disruptive technique using pheromone-impregnated luretape was established, monitored, and evaluated to determine its effectiveness in low level population management. Also in 1988, a sticky band substance (Tanglefoot®) was used as a barrier on two heavily infested white oak trees in an attempt to prevent larvae from climbing upward and defoliating these trees.

INTERVENTION ACTIVITIES--1988

Disparlure Treatment Evaluation

In March and April of 1988, a study area was established in the eastern portion of Jumonville Glen to evaluate disparlure (Luretape), a product developed for low-level gypsy moth population management. The area was located in a region of the park that has a fairly large oak component and where resident gypsy moth populations were estimated to be relatively low based on the 1987 egg mass survey data. The objective of the study was to see how effective Luretape would be in maintaining low level gypsy moth populations within a treated area as well as using it as a barrier to protect a given untreated area. A 100 foot wide rectangular strip encompassing approximately 6.6 acres made up the treated luretape area. The core of the treated rectangular strip contains an untreated area of approximately 8.8 acres. The control area for which treatment effects would be compared, borders the outside of the treated rectangular strip and is approximately 18.6 acres in size (Figure 1).

Within all three of these defined areas, twelve (12) systematically distributed 1/40th acre fixed radius plot were established to more accurately describe pre-treatment resident gypsy moth populations. Within the designated luretape area, two 1.5"x2" plastic dispensers impregnated with a total of 996 mg of disparlure was deployed at 10 meter intervals. The application rate for the treated area is approximately 40 grams of disparlure per acre.

In November of 1988, post-treatment egg mass counts were conducted using the same methods and at the same intensity previously mentioned. Table 1 presents a comparison of pre- and post-treatment egg mass survey results. Post-treatment counts have increased 304 percent in the outside control area, 166 percent in the inside untreated area and 154 percent in the luretape treatment area.

The relative success of mating was evaluated by collecting twelve egg masses from each of the three areas. The egg masses were placed in petri dishes, reared at the Morgantown Entomology Laboratory, and monitored for larval emergence. Once larvae emerged from an egg mass, it was considered to have been successfully fertilized. All 36 of the collected egg masses hatched.

Tanglefoot® Banding

In April of 1988, two large heavily infested white oak trees near grid point FO-11 were banded with Tanglefoot. The purpose of the banding was to see if the sticky substance would serve as an effective barrier to prevent ascending gypsy moth larvae from reaching the tree crown and consequently causing defoliation. The egg mass survey at this grid point in 1987 revealed 26 and 8 egg masses on these two trees.

A four-inch band of Tanglefoot was applied to both of these trees approximately four feet off of the ground. Larvae would congregate below the bands and were subsequently destroyed when the bands were inspected each week. A total of 955 larvae were collected and destroyed from the two trees and no noticeable defoliation occurred during the summer of 1988.

DETECTION ACTIVITIES--1988

Defoliation Survey

The defoliation survey results were obtained through the interpretation of the 1:12,000 scale 9"x9" color imagery taken on July 7, 1988, and by conventional aerial sketch mapping techniques on July 8, 1988. No noticeable defoliation occurred at or adjacent to Fort Necessity during the past summer.

MONITORING ACTIVITIES--1988

Larval and Pupal Monitoring

During the week of June 15, 1988, twenty grid points were banded with burlap in order to monitor larval and pupal activity. At each selected grid point, five oak trees near the grid point center were banded (at grid point FO-11, only two trees were banded). These bands were monitored weekly. Larvae and pupae underneath the bands were counted and then destroyed. Table 2 presents a comparison of the 1987 and 1988 banding results. The average number of larvae per banded grid point has increased 2775 percent from the 1987 level of 4 to the 1988 level of 115. The average number of pupae per banded grid point has increased from 3 in 1987 to 28 in 1988, an increase of 833 percent.

Male Moth Trapping

In June, 1988, the standard milk carton trap was deployed at all 43 grid points at Fort Necessity. Each trap was checked three times, the last check being in late August. When a trap was checked, the male moths were counted and

discarded and the numbers recorded. Figure 2 shows the grid point locations and the total number of male moths caught at each location. Male moth catches ranged from 72 to 1401 and averaged 698 per trap. The average catch per trap increased 210 percent from the 1987 average of 225 male moths. Every trap deployed showed an increase in the number of moths caught compared to the 1987 catch. A comparison of the 1987-88 cumulative male moth catch is presented in Table 3.

Egg Mass Surveys

Egg mass surveys using 1/40th acre fixed radius plots were conducted at all 43 grid points on November 8 and 9, 1988. (Table 4 presents a comparison of 1987-88 egg mass counts for each grid point.) Figure 3 shows the grid point locations as well as the egg mass count. Egg mass counts at the grid points ranged from 0 to 1900 egg massed per acre. The 1988 average of 194 egg masses per acre is a 259 percent increase over the 1987 average of 54 egg masses per acre. Twenty-six percent of the plots in 1988 have egg mass counts which exceed the commonly used defoliation threshold of 250 egg masses per acre compared to zero percent in 1987. For illustration purposes, Figure 4 presents a comparison of the percentage of plots within each egg mass density category for 1987 and 1988.

Hazard Rating

On June 20 and 21, 1988, all the grid points were evaluated to assess the potential stand defoliation (susceptibility) and mortality (vulnerability) should a heavy infestation occur. A 10 BAF variable radius plot was established at the center of each grid point. The species, diameter, basal area, and crown condition were recorded for all "in" trees.

Each grid point was then rated as either being susceptible or resistant to gypsy moth defoliation using the simplified version of the rating system devised by Houston and Valentine[1]. This rating system uses diameters and basal area of preferred hosts (oaks) in determining if a stand is susceptible or resistant to defoliation. Grid points that are likely to experience defoliation during a heavy infestation are classified as susceptible and grid points where defoliation is unlikely to occur are classified as being resistant. Table 5 presents defoliation potential classification for each grid point. Figure 5 shows the grid point locations along with the susceptbility rating at each grid point. Approximately half of the grid points (49 percent) were classified as being susceptible to defoliation while the other half (51 percent) were classified as being resistant to gypsy moth defoliation.

The grid points were also rated for vulnerability to tree mortality following defoliation using a rating system devised by Gansner and Herrick[2]. This rating system uses the percent of live trees in the white oak species group and the percent of live trees with poor crowns in order to predict mortality. This rating system classifies mortality as being light (less than 10 percent), moderate (11-25 percent), or heavy (greater than 25 percent). Table 6 presents the vulnerability rating by grid point. Figure 6 shows the grid point locations along with the vulnerability rating for each grid point.

Eighty-eight percent of the plots were rated as being vulnerable to light mortality, twelve percent were rated as being vulnerable to moderate mortality, and none were rated as being vulnerable to heavy mortality.

DISCUSSION

All phases of the monitoring activities show a large increase in the level of gypsy moth populations. The results show a 210 percent increase in the male moth catch, 259 percent increase in egg masses, 833 percent increase in pupae, and 2775 percent increase in the number of larvae observed.

Park-wide egg mass counts now average 194 egg masses per acre (Range = 0-1900). The heaviest concentration of egg masses are found in the southern portion of Fort Necessity. This area averaged 344 egg masses per acre and is likely to see some scattered moderate-heavy tree defoliation in 1989.

The total number of egg masses observed on the two large white oak trees banded with Tanglefoot decreased from 26 in 1987 to 17 in 1988 and no noticeable defoliation occurred. Although it is difficult to assess how much of an impact the sticky barrier actually provides, it definitely provided an excellent collection point at which a significant number of larvae was removed and and destroyed before they could reach the crown of the trees. This tactic may be worth repeating on the same trees in 1989 since these trees have a significant number of egg masses on them.

Post-treatment gypsy moth egg mass densities within the disparlure study area increased in the treated area, the outside control and the inside non-treated area. The percent increase in the outside control area was almost double that of both the treated area and the inside non-treated area (304 percent vs. 154 and 166 percent, respectively). Although this was not a replicated study, the large difference between gypsy moth populations in the outside control and the other two portions of the study area may indicate some treatment effect. Since Luretape is effective for at least two years, the evaluation will continue through 1989.

The purpose of the hazard rating work was to provide some base-line information regarding tree susceptiblity to gypsy moth defoliation as well as tree vulnerability to mortality in the Fort Necessity area. In general, approximately 40 percent of the grid points at Fort Necessity, 100 percent at Braddocks Grave, and 60 percent in the Jumonville Glen area were rated as being susceptible to gypsy moth defoliation. None of these areas had high ratings for tree mortality. The results in the woodlot at Braddock's Grave however, did indicate, moderate tree mortality (11-25 percent) could occur throughout much of this area. Although the grid point hazard rating data collected thus far provides us with the general picture, it should be considered preliminary as more intensive surveys will be needed to better describe these areas. A cover type may and/or breaking the areas up into management units would improve the usefulness of this information as a basis for making gypsy moth management decisions.

At present, Fayette County has proposed to aerially treat high gypsy moth populations within the county in 1989. One of the proposed treatment areas is located about a mile southeast of Fort Necessity. This activity and the results of the monitoring program indicate that sufficient numbers of gypsy moth will likely exist in and around Fort Necessity to cause significant defoliation as early as 1990. In light of this we offer the following recommendations for actions to be implemented in 1989:

1. Monitoring efforts should continue at the same intensity;

2. Expand on the existing hazard rating data by conducting a more intensive survey utilizing available cover-type maps and/or defined management units;

3. Identify any specific areas where defoliation and/or tree mortality would adversely impact the Park's management objectives;

4. Continue to use mechanical means of control (i.e. removing egg masses, destroying larvae using burlap or sticky bands) on selected trees determined to be of significance to the Park;

5. Continue to evaluate the disparlure treatment area;

6. Coordinate with Fayette County personnel to share information on gypsy moth populations in the vicinity of the Park; and

7. Develop a gypsy moth management plan using the collective available information.

References

[1]Houston, D.R. and H.T. Valentine. Classifying Forest Susceptibility to Gypsy Moth Defoliation. Agriculture Handbook #542, 1985.

[2]Gansner, D.A. and O.W. Herrick. Guides to Estimating Forest Stand Losses to Gypsy Moth. Northern Journal of Applied Forestry 2:21-23; 1984.

TABLE 1.--Pre- and Post-Treatment Egg Mass Counts in Disparlure Study Area. Fort Necessity National Battlefield, 1988

Area	Pre-treatment (egg masses/acre)	Post-treatment (egg masses/acre)	Percent Increase
Lure Tape	67	170	154%
Inside Control	80	213	166%
Outside Control	57	230	304%

TABLE 2.--Comparison of Number of Larvae/Pupae Observed at Banded Grid Points in 1987 and 1988. Fort Necessity National Battlefield.

Grid Point	No. of Larvae 1987	No. of Larvae 1988	No. of Pupae 1987	No. of Pupae 1988
FB 9	5	*	8	*
FC 6	3	*	3	*
FD 4	0	*	0	*
FD 9	0	34	0	39
FE 13	2	11	3	7
FF 5	7	*	14	*
FF 7	4	67	2	25
FF 11	0	0	0	9
FG 8	3	232	2	5
FH 7	6	336	5	16
FH 9	3	191	3	25
FH 10	0	68	0	27
FI 8	0	1	0	2
FI 11	7	106	3	10
FI 13	2	209	2	26
FI 15	2	*	0	*
FK 7	2	247	7	35
FL 4	*	30	*	34
FL 11	0	*	0	*
FL 12	1	142	0	20
FM 10	0	*	0	*
FN 5	*	81	*	42
FN 8	*	17	*	0
FO 11	18	231	6	211
Fort Average	3	118	3	31
JA 2	1	26	1	8
JA 3	10	*	6	*
JA 4	17	262	12	8
Jumonville Ave.	9	144	6	8
BA 1	0	3	0	4
BA 2	0	*	0	*
Braddock Average	0	3	0	4
Overall Average	4	115	3	28

* = Grid Point Not Banded

TABLE 3.--Comparison of 1987 and 1988 Male Moth Catches by Grid Point. Fort Necessity National Battlefield.

Grid Point	Number of Moths 1987	Number of Moths 1988
FB 9	186	399
FC 6	258	848
FC 10	156	353
FD 4	261	651
FD 9	204	1001
FD 13	17	97
FE 13	356	578
FF 5	377	866
FF 7	230	923
FF 9	*	750
FF 11	0	72
FG 8	353	1073
FG 12	149	409
FG 15	369	806
FH 7	374	997
FH 9	447	856
FH 10	476	1064
FI 6	282	653
FI 8	114	264
FI 11	272	970
FI 13	71	592
FI 15	229	258
FJ 4	*	522
FJ 15	92	538
FK 7	148	1018
FL 4	*	1219
FL 9	364	1137
FL 11	129	256
FL 12	147	805
FM 10	164	690
FN 5	*	1401
FN 8	*	547
FN 13	121	340
FO 7	*	952
FO 11	105	434
Fort Average	222	695
JA 1	213	1273
JA 2	234	478
JA 3	394	492
JA 4	387	837
JA 5	438	596
Jumonville Average	333	735

Table 3. (cont.)

Grid Point	Number of Moths 1987	Number of Moths 1988
BA 1	73	688
BA 2	63	737
BA 3	67	570
Braddock Average	68	665
Overall Average	225	698

* Trap Missing or Not Deployed

TABLE 4.--Comparison of 1987 and 1988 Egg Mass Counts by Grid Point.
Fort Necessity National Battlefield

Grid Point	Number of Egg Masses/Acre 1987	Number of Egg Masses/Acre 1988
FB 9	120	120
FC 6	40	280
FC 10	0	0
FD 4	80	440
FD 9	40	120
FD 13	0	0
FE 13	80	0
FF 5	160	920
FF 7	40	800
FF 9	80	360
FF 11	160	0
FG 8	160	80
FG 12	80	0
FG 15	80	0
FH 7	80	80
FH 9	40	440
FH 10	80	600
FI 6	40	40
FI 8	*	0
FI 11	0	80
FI 13	0	0
FI 15	40	0
FJ 4	*	0
FJ 15	0	0
FK 7	40	80
FL 4	*	280
FL 9	0	0
FL 11	80	0
FL 12	*	40
FM 10	0	0
FN 5	*	600
FN 8	*	0
FN 13	0	0
FO 7	*	1900
FO 11	**(26)	**(17)
Fort Average	56	213
JA 1	0	160
JA 2	120	0
JA 3	0	0
JA 4	0	160
JA 5	240	480
Jumonville Average	72	160

Table 4. (cont.)

Grid Point	Number of Egg Masses/Acre 1987	Number of Egg Masses/Acre 1988
BA 1	40	0
BA 2	0	0
BA 3	0	80
Braddock Average	13	27
Overall Average	54	194

* Grid Point Established in 1989
** Grid Point Not Suitable for 1/40th acre Survey Plot. Actual Egg Mass Count in Parenthesis.

TABLE 5.--Rating of Stand Susceptibility by Grid Point. Fort Necessity National Battlefield, 1988 Activities.

Grid Point	Susceptibility Rating	Grid Point	Susceptibility Rating
JA 1	R	FG 15	R
JA 2	R	FH 7	S
JA 3	S	FH 9	S
JA 4	S	FH 10	S
JA 5	S	FI 6	R
		FI 8	R
BA 1	S	FI 11	S
BA 2	S	FI 13	S
BA 3	S	FI 15	R
		FJ 4	R
FB 9	S	FJ 15	R
FC 6	S	FK 7	R
FC 10	S	FL 4	R
FD 4	R	FL 9	R
FD 9	S	FL 11	R
FD 13	R	FL 12	S
FE 13	S	FM 10	R
FF 5	R	FN 5	R
FF 7	S	FN 8	R
FF 9	S	FN 13	R
FF 11	R	FO 7	S
FG 8	R	FO 11	S
FG 12	R		

S = Susceptible to Defoliation
R = Resistant to Defoliation

TABLE 6.--Rating of Stand Vulnerability by Grid Point. Fort Necessity National Battlefield, 1988 Activities.

Grid Point	Vulnerability Rating	Grid Point	Vulnerability Rating
JA 1	L	FG 15	L
JA 2	L	FH 7	L
JA 3	L	FH 9	L
JA 4	L	FH 10	L
JA 5	L	FI 6	L
		FI 8	L
BA 1	L	FI 11	L
BA 2	M	FI 13	L
BA 3	M	FI 15	L
		FJ 4	L
FB 9	L	FJ 15	L
FC 6	L	FK 7	L
FC 10	L	FL 4	L
FD 4	L	FL 9	L
FD 9	L	FL 11	L
FD 13	L	FL 12	L
FE 13	M	FM 10	L
FF 5	L	FN 5	L
FF 7	L	FN 8	L
FF 9	L	FN 13	L
FF 11	L	FO 7	L
FG 8	L	FO 11	M
FG 12	M		

L = Potential for Low Mortality (0-10%)
M = Potential for Moderate Mortality (11-25%)
H = Potential for High Mortality (26-100%)

Figure 1. -- Pheromone Luretape Study Area. Jumonville Glen Unit of Fort Necessity National Battlefield, 1988 activities.

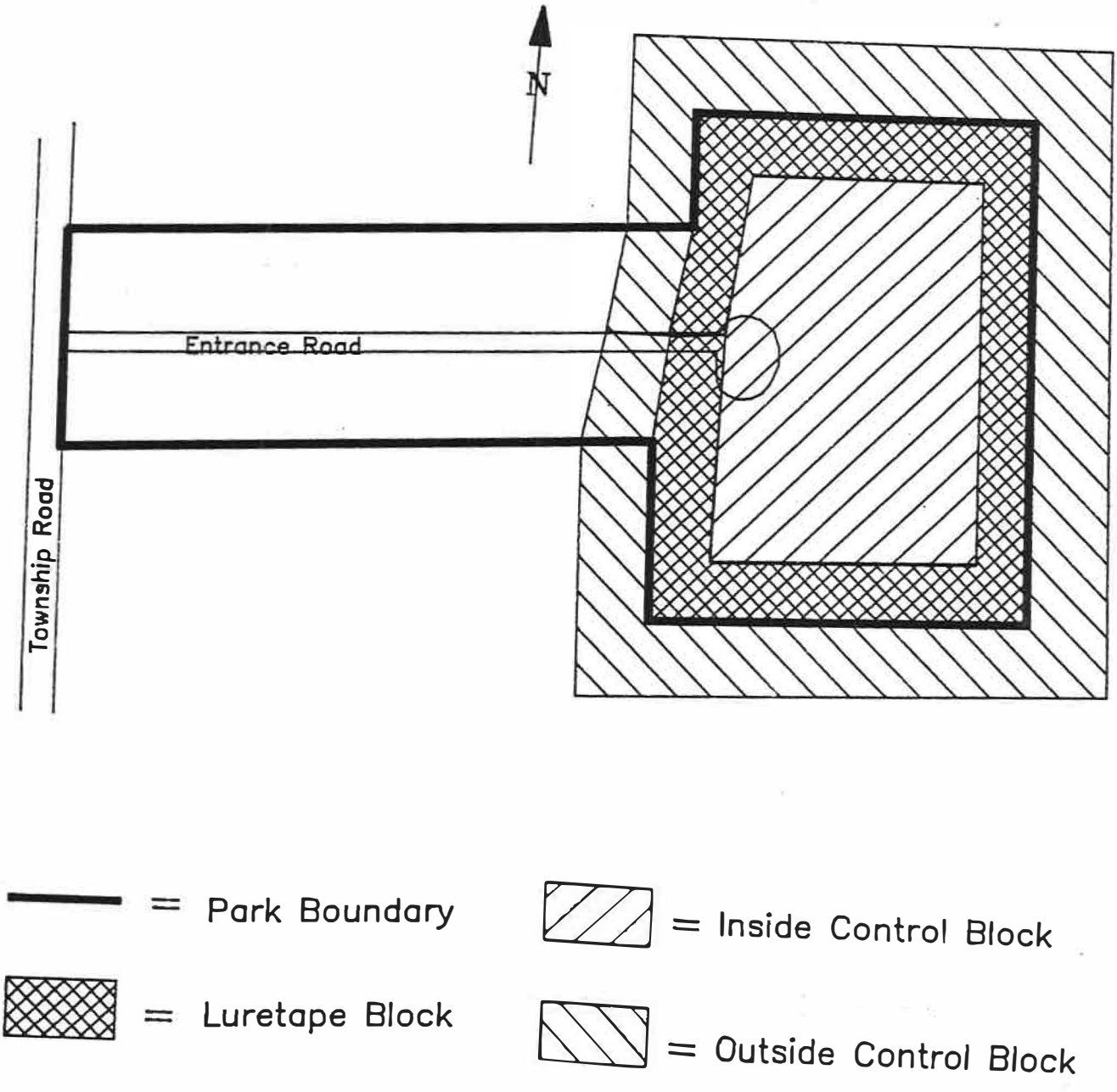


Figure 2.--Number of Male Gypsy Moths Caught at Each Grid Point. Fort Necessity National Battlefield, 1988.

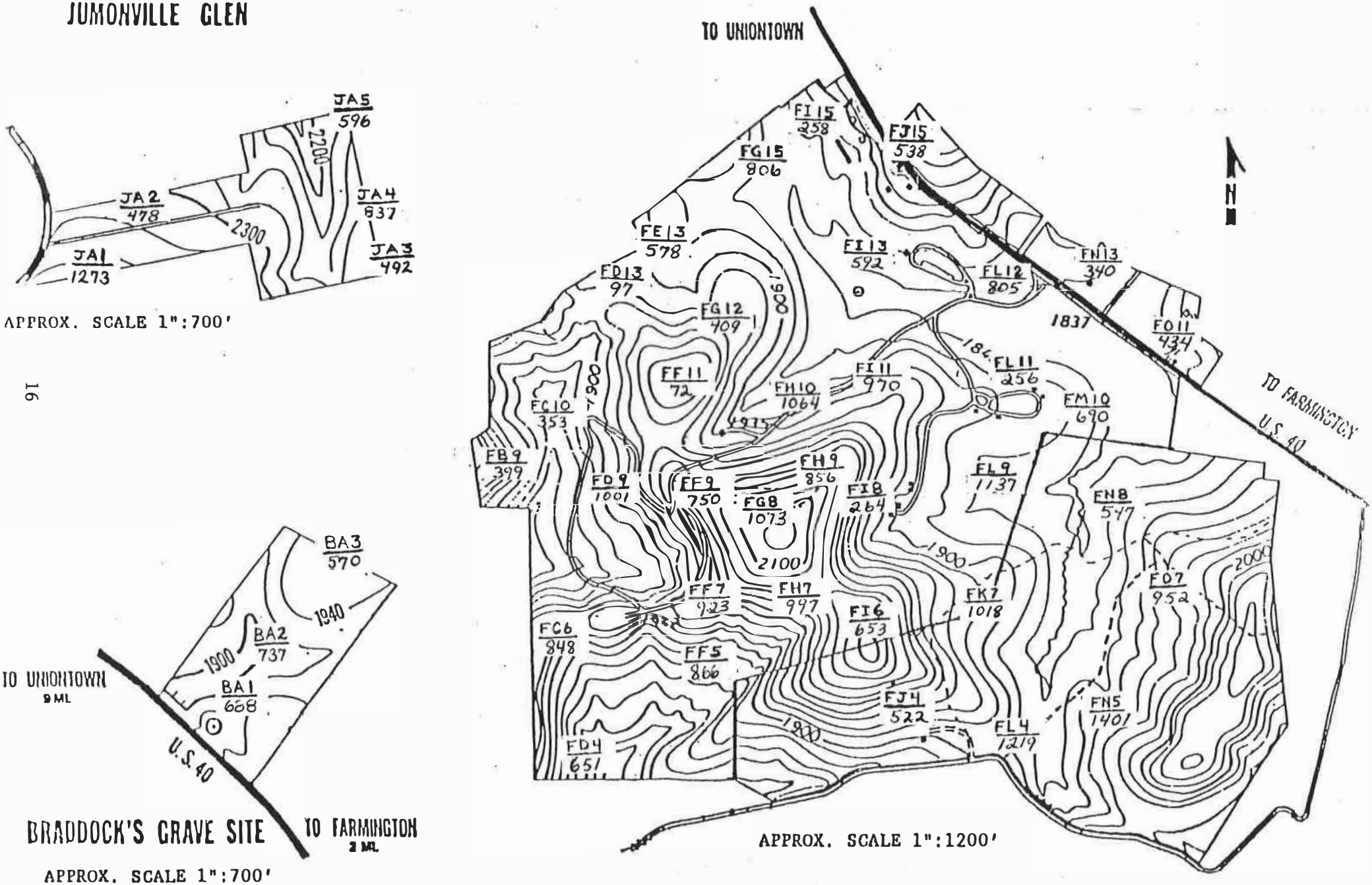
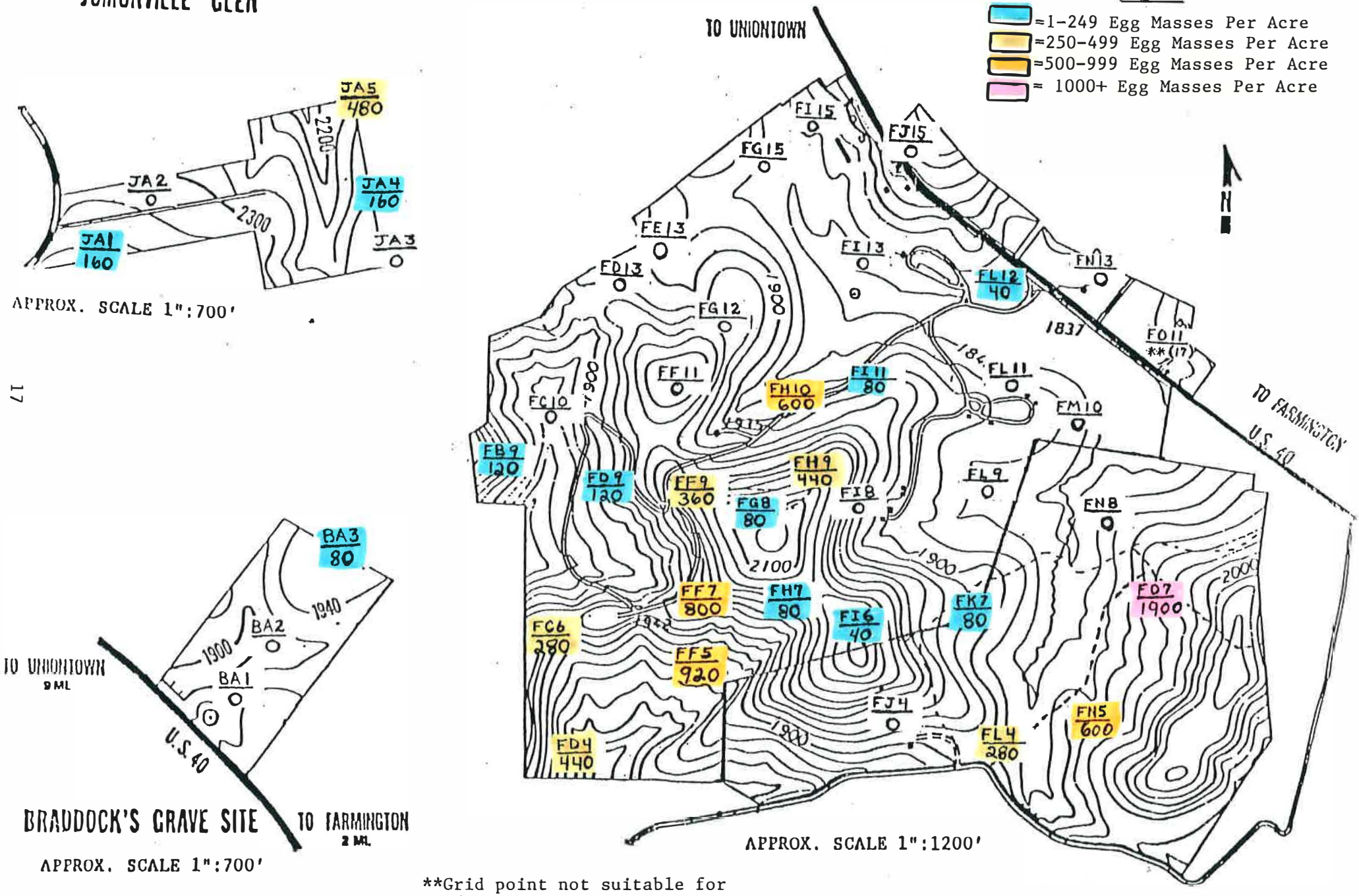


Figure 3.--Number of Egg Masses Per Acre at Each Grid Point. Fort Necessity National Battlefield, 1988.



**Grid point not suitable for 1/40-acre survey plot. Actual egg mass count in parenthesis.

Figure 4. -- Comparison of the Percentage of Plots Within Each Egg Mass Density Category. Fort Necessity National Battlefield, 1987 and 1988.

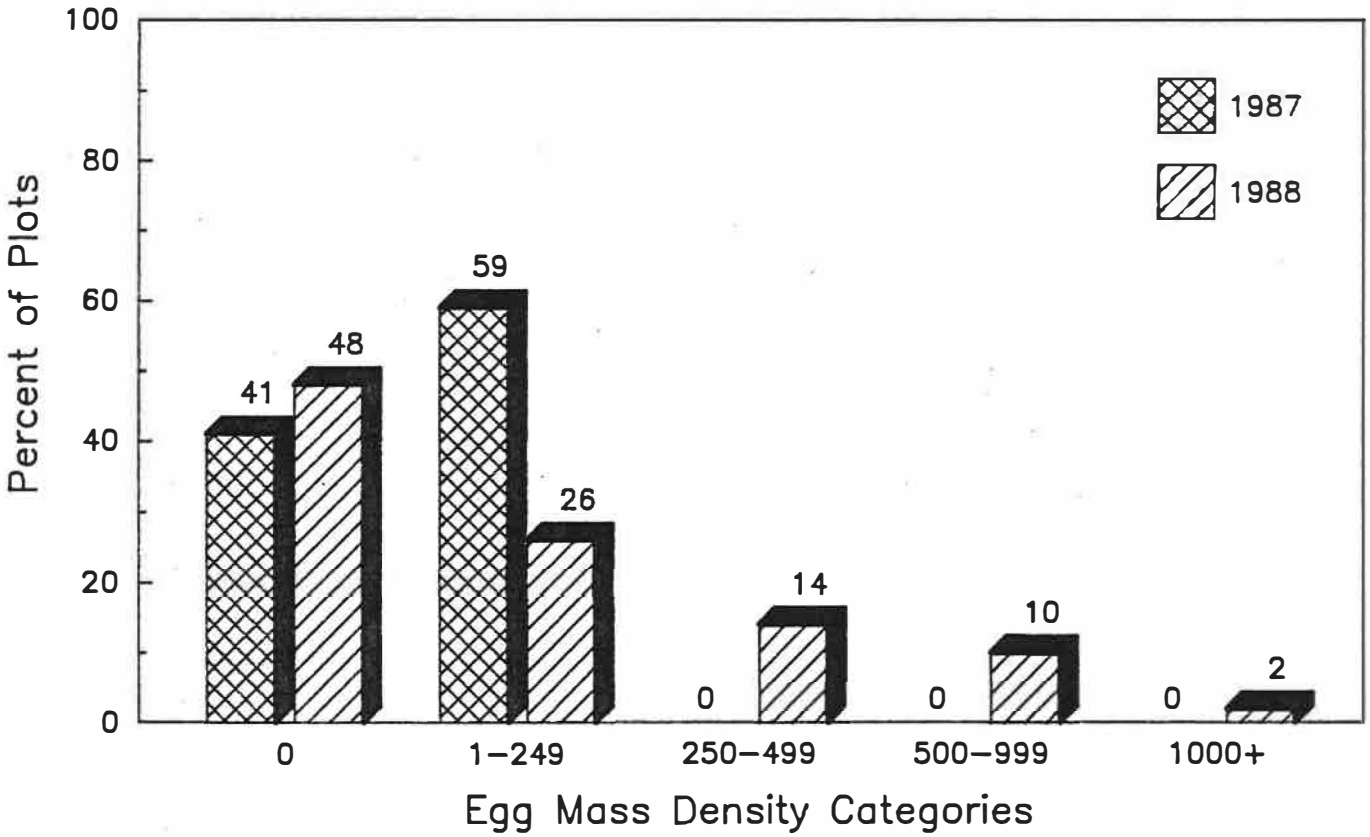


Figure 5.--Rating of Stand Susceptibility by Grid Point. Fort Necessity National Battlefield, 1988.

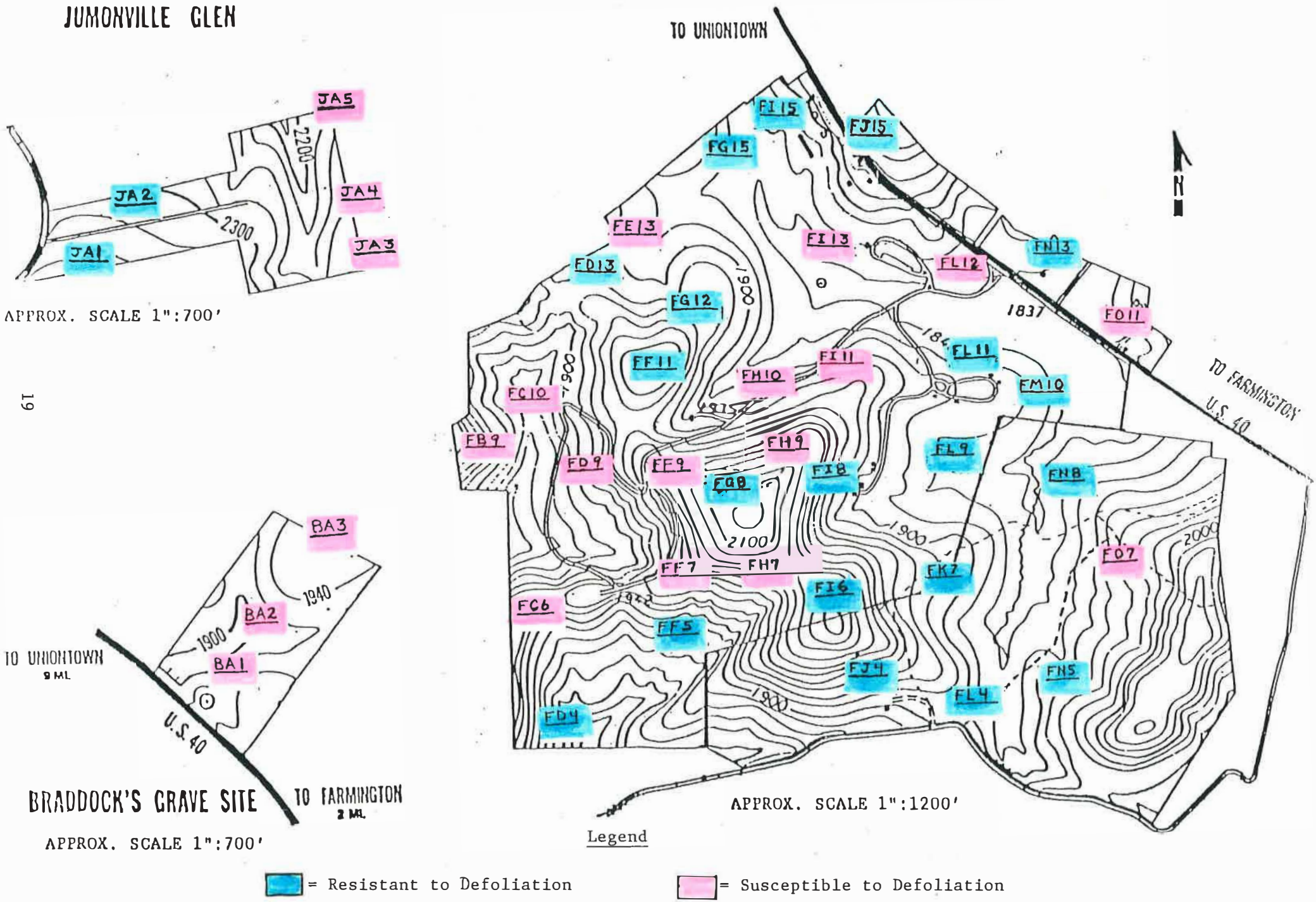


Figure 6.--Rating of Stand Vunerability by Grid Point. Fort Necessity National Battlefield, 1988.